

Docket No. 501.43637X00
Serial No.10/797,011
Office Action dated August 10, 2007

REMARKS

I. Introduction

By the present Amendment, claims 1-5, 7, 9, 11-13, and 15 have been amended. No claims have been added or cancelled. Accordingly, claims 1-17 remain pending in the application. Claims 1, 3, 7, 9, 11, and 15 are independent.

II. Office Action Summary

In the Office Action of August 10, 2007, claims 7 and 15 were objected to under 37 CFR §1.75(a) as failing to particularly point out and distinctly claim the subject matter regarded as the invention. Claims 1, 7, 9, and 15 were rejected under 35 USC §102(b) as being anticipated by U.S. Patent No. 5,051,585 issued to Koshishiba et al. ("Koshishiba"). Claims 2 and 10 were rejected under 35 USC §103(a) as being unpatentable over Koshishiba in view of U.S. Patent Application No. 2002/022185 to Tanaka et al. ("Tanaka"), and further in view of U.S. Patent No. 6,169,282 to Maeda. Claims 3, 6, 11, and 14 were rejected under 35 USC §103(a) as being unpatentable over Koshishiba in view of U.S. Patent Application No. 2003/021462 to Sakai et al. ("Sakai"). Claims 4, 5, 12, and 13 were rejected under 35 USC §103(a) as being unpatentable over Koshishiba in view of Sakai, and further in view of U.S. Patent Application No. 2003/0118217 to Kondo et al. ("Kondo"). Claims 8 and 16 were rejected under 35 USC §103(a) as being unpatentable over Koshishiba in view of U.S. Patent Application No. 2003/0081201 to Shibata et al. ("Shibata"). Claim 17 was rejected under 35 USC §103(a) as being unpatentable over Koshishiba in view of Maeda. These rejections are respectfully traversed.

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III. Objections under 37 CFR §1.75

Claims 7 and 15 were objected to under 37 CFR §1.75(a) as failing to particularly point out and distinctly claim the subject matter regarded as the invention. Regarding this objection, the Office Action indicates that claims 7 and 15 recite the phrase "processing speed substantially equal to an image capturing speed." The Office Action alleges that the term "substantially" is ambiguous and does not define exactly what range is being claimed. Applicants respectfully disagree.

It is well established that the term "substantially" does not render a claim indefinite. See *In re Mattison*, 509 F.2d 563 (C.C.P.A. 1975); *Ex parte George*, 230 USPQ 575 (B.P.A.I. 1984); *Andrew Corp. v. Gabriel Elecs.*, 847 F.2d 819 (Fed. Cir. 1988); *York Prods., Inc. v. Central Tractor Farm & Family Ctr.*, 99 F.3d 1568 (Fed. Cir. 1996). Furthermore, similar terms (such as essentially and about) have also been held to be definite. See *Eiselstein v. Frank*, 52 F.3d 1035 (Fed. Cir. 1995); *In re Marosi*, 710 F.2d 799 (Fed. Cir. 1983); *Zoltek Corp. v. United States*, 48 Fed. Cl. 290, 57 USPQ2d 1257 (Fed. Cl. 2000); *Syntex (U.S.A.) Inc. v. Paragon Optical Inc.*, 7 USPQ2d (D. Ariz. 1987); *W. L. Gore & Assocs. V. Garlock, Inc.*, 721 F.2d 1540 (Fed. Cir. 1983). As the Examiner can surely appreciate, it is not possible to measure any property with exact and absolute precision. Accordingly, any measured value represents a relative value based on the type and accuracy of the equipment being used to conduct the measurement. Further, as discussed in the cases identified above, the Federal Circuit has clearly indicated how such language should be interpreted. Applicants further invite the Examiner to conduct a search of

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issued patents and note the number of results which include similar language in the claims.

Applicants respectfully submit that as defined in the claimed invention, the term "substantially equal" does not render the claimed invention ambiguous. Withdrawal of this objection is therefore respectfully requested.

IV. Rejections under 35 USC §102

Claims 1, 7, 9, and 15 were rejected under 35 USC §102(b) as being anticipated by Koshishiba. Regarding this rejection, the Office Action indicates that Koshishiba discloses a method of inspecting a pattern that comprises the steps of sensing images in order to obtain a reference image and an inspection image, performing correction of a difference in brightness between each of first unit areas and a difference in brightness for each of second unit areas which are larger than the first unit areas, and detecting a defect using the reference image and the inspection image for which the correction of brightness for each first unit area and for each second unit area have been performed. Applicants respectfully disagree.

As amended, independent claim 1 defines a method of inspecting a pattern that comprises the steps of:

sensing images of corresponding areas of two patterns, which are originally formed so as to have an identical shape on a substrate, to obtain a reference image and an inspection image;

with respect to the reference image and the inspection image obtained by sensing images of the corresponding areas, performing a first correction of a difference in brightness for each corresponding first unit area and performing a second correction of a difference in brightness for each of second unit area which covers at least one of the first unit areas; and

detecting a defect using the reference image and the inspection image for which the correction of brightness for each first

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unit area and the correction of brightness for each second unit area have been performed.

According to independent claim 1, images of corresponding areas of two patterns that were originally formed to have an identical shape on a substrate are sensed in order to obtain a reference image and an inspection image. A first correction of a difference in brightness for each corresponding first unit area is performed for the reference image and the inspection image. A second correction of a difference of brightness for each of second unit areas which cover at least one of the first unit areas is performed. Next, a defect is detected using the reference image and the inspection image for which the correction of brightness for each first unit area and the correction of brightness for each second unit area have been performed.

The Office Action alleges that Koshishiba discloses all of the features recited in independent claim 1. This does not appear to be the case. Koshishiba discloses a pattern detection apparatus that uses a scanning electron microscope having an electron gun for generating and accelerating an electron beam. See Abstract. The apparatus also includes a brightness correcting mechanism that allows for correction of a drift in brightness of the detected image. According to Koshishiba, brightness is corrected by controlling the supply voltage to the photo electron multiplying tube such that the peak brightness of the distribution is constant. The gain of the amplifier or the intensity of the electron gun can also be used as control parameters. See column 11, line 60 to column 12, line 5.

Contrary to independent claim 1, Koshishiba appears to only perform a single step brightness correction. There does not appear to be any disclosure or suggestion for a first and second brightness correction step. The Office Action purports to allege that various brightness difference steps are performed. The cited

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passages, however, do not disclose such features. Rather, Figures 14 and 15 merely illustrate that a brightness correcting mechanism exists. The corresponding passage appears to be completely silent on performing a two-step brightness difference correction. Consequently, Koshishiba necessarily fails to detect the defects based on the results of the brightness correction for each first unit area and the brightness correction for each second unit area. More particularly, the cited reference fails to provide any disclosure or suggestion for features recited in independent claim 1, such as:

with respect to the reference image and the inspection image obtained by sensing images of the corresponding areas, performing a first correction of a difference in brightness for each corresponding first unit area and performing a second correction of a difference in brightness for each of second unit area which covers at least one of the first unit areas; and

detecting a defect using the reference image and the inspection image for which the correction of brightness for each first unit area and the correction of brightness for each second unit area have been performed.

It is therefore respectfully submitted that independent claim 1 is allowable over the art of record.

Claim 2 depends from independent claim 1, and is therefore believed allowable for at least the reasons set forth above with respect to independent claim 1. In addition, this claim introduces novel elements that independently render it patentable over the art of record.

Independent claim 7 defines a method of inspecting a pattern that comprises the steps of:

sequentially sensing images of corresponding areas of two patterns, which are originally formed so as to have an identical shape on a substrate, using an image sensor to sequentially capture images of the corresponding areas; and

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performing a first correction of positional deviation of the sensed images of corresponding areas of two patterns, a second correction of difference in brightness between the sensed images of corresponding areas of two patterns by two steps in which the first step includes subjecting plural small areas and the second step includes subjecting a large area which covers the plural small areas, and a detection of a defect by parallel processing with respect to images subsequently captured by sensing images of the areas with the image sensor,

wherein the images are processed at a processing speed substantially equal to an image capturing speed of the image sensor.

According to at least one feature of independent claim 7, a first correction of positional deviation of the sensed images of corresponding areas of two patterns is performed. Next, a second correction is performed based on the difference in brightness between the sensed images of corresponding areas of two patterns using two steps. In the first step, plural small areas are subjected to the brightness difference correction, while a large area which covers these plural small areas is subjected to the difference in brightness correction in the second step. A defect is detected by parallel processing with respect to images that are captured by sensing images of the areas with an image sensor.

As previously discussed with respect to independent claim 1, the cited reference fails to provide any disclosure or suggestion for performing the brightness correction in two steps. Rather, a single step appears to be performed in order to correct the brightness difference.

It is therefore respectfully submitted that independent claim 7 is allowable over the art of record.

Claim 8 depends from independent claim 7, and is therefore believed allowable for at least the reasons set forth above with respect to independent

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claim 7. In addition, this claim introduces novel elements that independently render it patentable over the art of record.

Independent claim 9 defines an apparatus for inspecting a pattern that comprises:

image sensing means which senses images of corresponding areas of two patterns, which are originally formed so as to have an identical shape on a substrate; and

image processing means which uses a reference image and an inspection image, which are obtained by sensing images of the areas using the image sensing means, to detect a defect,

wherein the image processing means comprises:

a brightness correction unit which, with respect to the reference image and the inspection image obtained by sensing images of the corresponding areas, performs a first correction of a difference of brightness for each corresponding first unit area and further performs a second correction of a difference of brightness for each second unit area which covers at least one of the first unit areas; and

a defect detection unit which detects a defect using the reference image and the inspection image for which the correction of brightness for each first unit area and the correction of brightness for each second unit area have been performed by the brightness correction unit.

According to independent claim 9, the apparatus includes, in part, an image processing means that comprises a brightness correction unit which performs brightness correction in a manner that is somewhat similar to that recited in independent

claim 1. More particularly, the brightness correction unit performs two brightness corrections. As previously discussed, such a feature is not disclosed or suggested by the art of record.

It is therefore respectfully submitted that independent claim 9 is allowable over the art of record.

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Claim 10 depends from independent claim 9, and is therefore believed allowable for at least the reasons set forth above with respect to independent claim 9. In addition, this claim introduces novel elements that independently render it patentable over the art of record.

Independent claim 15 defines an apparatus for inspecting a pattern that comprises:

image sensing means which sequentially senses images of corresponding areas of two patterns, which are originally formed so as to have an identical shape on a substrate, using an image sensor to sequentially capture images of the corresponding areas; and

defect detecting means which processes the images sequentially captured by the image sensing means to detect a defect,

wherein the defect detecting means comprises plural processing units for processing the images, which are sequentially captured by sensing images of the corresponding areas with the image sensor of the image sensing means, and executes a correction of positional deviation of the captured images of corresponding areas, a correction of difference in brightness between the captured images of corresponding areas by two steps in which the first step includes subjecting plural small areas and the second step includes subjecting a large area which covers the plural small areas, and a detection of a defect of the images, which are sequentially captured, in parallel in plural processing units to thereby process the images at a processing speed substantially equal to an image capturing speed of the image sensor of the image sensing means.

The apparatus of independent claim 15, includes, in part, a defect detecting means that comprises plural processing units for processing the images. The plural processing means, in part, perform a brightness connection between the captured images of corresponding areas in two steps. Furthermore, the two steps are somewhat similar to those recited in independent claim 7. As previously discussed, such features are not disclosed in the art of record.

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It is therefore respectfully submitted that independent claim 15 is allowable over the art of record.

Claims 16 and 17 depend from independent claim 15, and are therefore believed allowable for at least the reasons set forth above with respect to independent claim 15. In addition, these claims each introduce novel elements that independently render them patentable over the art of record.

V. Rejections under 35 USC §103

Claims 3, 6, 11, and 14 were rejected under 35 USC §103(a) as being unpatentable over Koshishiba in view of Sakai. Regarding this rejection, the Office Action alleges that Koshishiba discloses a method of inspecting a pattern that comprises most of the features recited in these claims. In particular, the Office Action alleges that Koshishiba discloses correcting a difference in brightness between the reference image and the inspection image in multiple stages by different area units. Sakai is relied upon for disclosing various other features that are not disclosed by Koshishiba. Applicants respectfully disagree.

As amended, independent claim 3 defines a method of inspecting a pattern that comprises the steps of:

sensing images of corresponding areas of two patterns, which are formed so as to originally have an identical shape on a substrate, to obtain a reference image and an inspection image;

correcting a difference of brightness between the reference image and the inspection image obtained by sensing images of the areas with two steps, in the first step subjecting plural small areas and in the second step subjecting a large area which covers the plural small areas;

comparing the images for which brightness is corrected in multiple stages to obtain a difference image between both images; and

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comparing the difference image with a threshold value corresponding to the areas of the images to detect a defect.

According to at least one feature of independent claim 3, the brightness correction between the reference image and the inspection image is performed in two steps. The first step subjects plural small areas to the brightness correction, while the second step subjects a large area which covers the plural small areas to the brightness correction. As previously discussed, these features are not shown or suggested by Koshishiba. Further, they also do not appear to be disclosed or suggested by Sakai. Accordingly, the combination of references still fails to disclose, or suggest, features recited in independent claim 3, such as:

correcting a difference of brightness between the reference image and the inspection image obtained by sensing images of the areas with two steps, in the first step subjecting plural small areas and in the second step subjecting a large area which covers the plural small areas;

It is therefore respectfully submitted that independent claim 3 is allowable over the art of record.

Claims 4-6 depend from independent claim 3, and are therefore believed allowable for at least the reasons set forth above with respect to independent claim 3. In addition, these claims each introduce novel elements that independently render them patentable over the art of record.

Independent claim 11 defines an apparatus for inspecting a pattern that comprises:

image sensing means which senses images of corresponding areas of two patterns, which are originally formed so as to have an identical shape on a substrate; and

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defect detecting means which detects a defect using the reference image and the inspection image obtained by sensing images of the corresponding areas with the image sensing means;

wherein the defect detecting means comprises:

a brightness correction unit which corrects a difference of brightness between the reference image and the inspection image, which are obtained by sensing images of the areas with the image sensing means, with two steps, in the first step subjecting plural small areas and in the second step subjecting a large area which covers the plural small areas;

a difference image generation unit which compares the images for which brightness is corrected by the two steps by the brightness correction unit to obtain a difference image between both the images; and

a defect detection unit which compares the difference image obtained by the difference image generation unit with a threshold value corresponding to the areas of the images to detect a defect.

The apparatus includes, in part, a brightness correction unit that corrects a difference in brightness between a reference image and the inspection image. The difference in brightness is corrected in such a manner that the first step subjects plural small areas, while the second step subjects a large area which covers the plural small areas. As previously discussed, these features are not shown or suggested by Koshishiba. Further, they also do not appear to be disclosed or suggested by Sakai. Accordingly, the combination of references still fails to disclose, or suggest, features recited in independent claim 11, such as:

a brightness correction unit which corrects a difference of brightness between the reference image and the inspection image, which are obtained by sensing images of the areas with the image sensing means, with two steps, in the first step subjecting plural small areas and in the second step subjecting a large area which covers the plural small areas;

It is therefore respectfully submitted that independent claim 11 is allowable over the art of record.

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Claims 12-14 depend from independent claim 11, and are therefore believed allowed for at least the reasons set forth above with respect to independent claim 11. In addition, these claims each introduce novel elements that independently render them patentable over the art of record.

VI. Conclusion

For the reasons stated above, it is respectfully submitted that all of the pending claims are now in condition for allowance. Therefore, the issuance of a Notice of Allowance is believed in order, and courteously solicited.

If the Examiner believes that there are any matters which can be resolved by way of either a personal or telephone interview, the Examiner is invited to contact Applicants' undersigned attorney at the number indicated below.


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AUTHORIZATION

Applicants request any shortage or excess in fees in connection with the filing of this paper, including extension of time fees, and for which no other form of payment is offered, be charged or credited to Deposit Account No. 01-2135 (Case: 501.43637X00).

Respectfully submitted,

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